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Foreign Direct Investment, Search Unemployment, and the Role of Labor Market Institutions

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Foreign Direct Investment, Search Unemployment, and the Role of Labor Market Institutions*

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Abstract

This paper proposes a simple multi-industry trade model with search frictions in the labor market. It will be shown that the reallocation of capital across countries in form of FDI leads to changes in unemployment at the extensive and intensive industry margins. Whether a country benefits from FDI highly depends on the respective country's net-FDI flows. Unilateral changes in labor market institutions trigger spillover effects induced by a reallocation of industries across countries, which affects labor markets in all economies integrated through trade. The model yields two predictions that are tested in the second part of the paper by use of OECD data on unemployment, FDI, and labor market institutions. It will be shown that net-FDI is robustly associated with lower rates of aggregate and skill-specific unemployment. Finally, the theoretical and empirical findings also suggest that countries that exhibit a high degree of employment protection, or union density tend to have relatively more outward-FDI flows.

JEL codes: F16, E24, J6

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1. Introduction

The ongoing internationalization of product and labor markets has stimulated a debate about the pros and cons of globalization. Supporters often stress the beneficial effects that arise due to increased export opportunities, whereas globalization's detractors are often more concerned about job losses due to heightened competition with workers from less developed countries. Economics can contribute to this debate in that it can rationalize the fear that more intensive global economic-interdependency generates by identifying the merits and downsides of this process and by quantifying the labor market outcomes of the potentially opposing effects. The public debate that surrounds these issues has frequently been characterized by a lack of clarity regarding the definition of globalization and a failure to account for different elements of this process which may have contrasting implications for domestic and international labor markets. In this paper we devote our attention to the implications of capital mobility for domestic and international labor markets by proposing an empirical test on the FDI and unemployment nexus. Besides the direct effects of FDI on unemployment we also analyze institutional spillover effects that stem from unilateral improvements in labor market institutions favoring the workers. The model presented in the theory section departs from previous studies in that the effect is ex-ante ambiguous and highly depends on whether a country is the FDI receiving or sending country.

The main contribution of the paper is to test the two-edged outcome of the model outlined in the next section, which is akin to Schmerer (2010) but which does not feature the distinction between low and high skill workers.¹ Such a procedure is justified by the outcome of skill-specific version of the model in the companion paper, where we show that both skill-groups are equally affected mainly due to the effects at the extensive margin. We thus show that the same effects can be replicated on the aggregate level in order to bring the model to the data using high quality OECD data. Skill-specific unemployment rates are used in the additional results chapter in order to test the complementarity described in the skill-specific version of the model. However, the results are somewhat superior to the aggregate unemployment regression results since the data

¹As shown in the companion paper, the effects of *FDI* or a change in labor market institutions equally evolves in both skill groups. The empirical strategy is therefore twofold. I nevertheless exploit data on skill-specific unemployment rates to show some evidence on the complementarity between high and low skilled workers as established in Schmerer (2010). However, the main empirical investigation focuses on aggregate data for reasons of data availability.

quality is less convincing and since the relatively short time span of the data does not allow us to purge the data from short-run fluctuations.

It will be shown that *FDI* directly affects labor demand on both the intensive and extensive margin. At the extensive industry margin the widening of the *FDI* receiving country's range of active industries is due to increased competitiveness in industries located close to the former cutoff, which boosts labor demand and thus decreases equilibrium unemployment. The impact of such an industry-reallocation from one to the other country is expected to be much stronger in magnitude than the effects caused by pure substitution between labor and capital. The effect is ambiguous and thus addressed in a numerical simulation.

Conversely, adjustments in the standard Pissarides (2000) framework with capital but without a continuum of industries occur at the intensive margin only. *FDI-inflows* in such a simple model reduce capital costs and thus lead to substitution of labor by capital.

To the best of my knowledge, this paper is the first focusing on the unemployment effects of global sourcing in a model with a continuum of industries from an empirical and a theoretical perspective. Lin and Wang (2008) present some empirical evidence on the effects of capital-outflows on equilibrium unemployment, but they neither provide a theoretical background to motivate their study, nor does their analysis feature the distinction between *FDI-net stocks* and flows. This distinction is crucial at least in the model presented in the theory section of this paper where we show that the sign of the effect is different depending on whether a country is the receiving or the sending country. Lin and Wang (2008) also do not control for other potential drivers behind unemployment, which might spur their results due to an omitted variable bias. Numerous theoretical and empirical studies on labor market institutions and its effects on unemployment suggest to control for institutions in related applications that deal with unemployment regressions.

Also closely related to this paper are two contributions by Mitra and Ranjan (2007) and Davidson and Matusz (2008) both focusing on the employment effects of outsourcing in trade models with search frictions. Mitra and Ranjan (2007) propose a two sector model with one input factor labor. In their model outsourcing decreases equilibrium unemployment. In Davidson and Matusz (2008) outsourcing forces some of the high skill workers in the North to search for jobs in the low skill sector. This stirs up job com-

petition in the low skill sector and thus triggers a rise in unemployment. Also closely related is a contribution by Kohler and Wrona (2010), where the relationship between offshoring and unemployment is non-monotonic. They identify channels through which offshoring can affect labor demand at the intensive and extensive margin. The two opposing effects lead to an outcome where the sign of the effect hinges on the level of offshoring.

From an empirical perspective the papers closely related to mine are Dutt, Mitra, and Ranjan (2009) and Felbermayr, Prat and Schmerer (2009) both providing empirical evidence on the effects of international trade on unemployment. I use the same methodology as proposed in both papers for the empirical test of the FDI and unemployment relationship highlighted in the theory section of this paper. Also closely related is a series of theoretical papers focusing on labor market effects triggered by globalization. Starting with Brecher (1974), researchers began to investigate the link between trade liberalization and international labor markets. Davidson and Matusz (1988, 2004) and Davidson et al. (1999) analyze those effects by incorporating the Pissarides search and matching framework with international trade models such as the Heckscher Ohlin model. Building on their work, Moore and Ranjan (2005) came forward with a model that allows to study how globalization affects skill-specific unemployment in a Heckscher Ohlin framework. More recently the spotlight has been directed towards the popular Melitz (2003) international trade model. Egger and Kreickemaier (2009) were the first to relax the full employment condition in the Melitz model by use of a fair wage constraint. However, their main interest lies in wage inequality rather than unemployment. Helpman and Itskhoki (2007) and Felbermayr, Prat, and Schmerer (2008) introduced search frictions into the Melitz (2003) model and study the effects of trade liberalization on unemployment. Based on this, Helpman, Itskhoki, and Redding (2008) and (2009) introduce worker heterogeneity into their model in order to investigate the effects of globalization on wage inequality and unemployment.

2. The benchmark model

I assume a two-level production process with a continuum of final consumption goods assembled using intermediate inputs, and capital. Intermediates are produced in the second level of the model using the homogeneous input factor labor. Labor markets

are imperfect due to search frictions so that firms have to post vacancies in order to recruit new workers. Once met, employers and employees engage in wage bargaining, and in case of a successful match the firm is established and starts producing the intermediate good. The standard Pissarides small firm assumption applies, wherefore each firm on level 2 employs exactly one worker and produces one unit of the intermediate good. Level 1 prices charged for the final consumption good and wages paid to workers producing the intermediates are closely related. Wages, goods prices, and thus world income is jointly determined in general equilibrium, thereby linking the different production levels.

Consumer demand. The whole continuum of goods is consumed by the representative household according to a standard aggregate demand function

$$\ln Y = \int_0^1 \ln x(z)^{\varphi(z)} dz , \quad (1)$$

where $x(z)$ is the quantity of the good from industry z consumed and $\varphi(z)$ is the Cobb Douglas share in z .² Aggregate demand evaluated by the price P must equal total expenditure $YP = E$. A fraction $\varphi(z)$ of world expenditure is spent on the consumption of good z and consumer demand is thus pinned down by

$$x(z) = \frac{\varphi(z)E}{c(z)} , \quad (2)$$

which states that total expenditure for z equals revenue generated in z . Perfect competition implies that revenue in industry z equals quantity times unit costs as in (2) and thus allows us to interact the consumption and production parts (level 1 and 2) of the model.

Level 1: Final good producers. Final goods are produced using the input factors capital and intermediate goods. The industries are ordered according to the input coefficients $a(z)$, which exogenously determine the requirement of intermediates needed to produce one unit of the consumption good. Each country specializes in producing in industries where it has a comparative advantage by means of lower unit costs compared

²Summing up the shares over the whole continuum of industries must equal unity.

to that in the competing country. Input coefficients in z are given by

$$a_i(z) = \alpha_i + \gamma_i(z) , \quad (3)$$

where index i denotes domestic (d) or foreign (f). The labor requirement comprises a non-industry specific component α and an industry-specific component that varies over the continuum. As in Dornbusch et al. (1977) technology differences across countries are necessary to derive a clear trade pattern according to each country's comparative advantage.³

To model final good production we postulate a Cobb Douglas production function

$$x_i(z) = [a_i(z)]^\zeta [k_i(z)]^{1-\zeta} . \quad (4)$$

The final industry output good is sold for a price $p(z)$. Perfect competition implies that the industry price level equals the respective industry unit costs

$$p_i(z) = c_i(z) = B(q_i a_i(z))^\zeta r_i^{1-\zeta} , \quad (5)$$

where $c(z)$ denotes minimum unit costs in sector z obtained by solving the cost minimization problem of the firm. Cost depend on prices paid for the intermediate inputs and capital. $B = \zeta^{-\zeta}(1 - \zeta)^{-(1-\zeta)}$ and $a(z)$ are given exogenously.

Wages are determined on level 2 and equalized across industries. Level 1 firms take prices charged by level 2 firms as given and adjust their labor demand based on the price q (in common units) charged by level 2 firms for the intermediate good.

Level 2: Intermediate input producers. In this final level labor is the sole input factor used to produce the intermediate input goods. Firms have to post vacancies in order to recruit new employees which incurs vacancy posting costs c prior to a successful match. I assume that vacancy posting costs are paid in terms of level 1 prices when solving the general equilibrium of the model.⁴ The matching process $m(\theta_i)$ is concave and has constant returns to scale properties. The problem of the firm and worker depends on firms'

³Another approach close to the Dornbusch et al. (1977) model is Eaton and Kortum (2002) where countries draw their productivity parameter from a country-specific distribution. Using equation (3) instead allows us to determine a clear industry ranking that facilitates extensions such as mine.

⁴This assumption is in line with Pissarides (2000).

revenue, unemployment benefits b , the bargaining power β , vacancy posting costs c , the discount rate η , and job destruction rate λ . See the detailed solution in the Appendix for further details on how to derive the equilibrium.

Lemma 1. *a) To derive a unique solution for intermediate goods' prices, q , the wage and job creation curves are interacted and solved as*

$$q_i = \frac{(1 - \beta)b_i}{(1 - \beta) - c(\beta\theta_i + \frac{\eta + \lambda}{m(\theta_i)})} \quad (6)$$

b) Wages, and therefore intermediate good prices, are increasing in θ_i since $\frac{\partial q_i}{\partial \theta_i} > 0$.

Proof. We can exploit $\frac{\partial m(\theta_i)}{\partial \theta_i} < 0$ in order to show that $\frac{\partial q_i}{\partial \theta_i} > 0$. The higher the vacancy to unemployment ratio, θ_i , the higher must be the equilibrium wage rate in order to attract enough workers to fill the vacancies. Higher wages in turn are linked to higher intermediate good prices paid by level 1 final good assemblers. \square

2.1. Labor market clearing

The existence of search frictions in the labor market gives rise to a situation where firms adjust their labor demand to the intermediate input prices depending on wages and search costs. Perfect competition with search frictions imply that the intermediate good's price comprises production costs plus expected recruitment costs.

Firms on level 1 are price takers and base their labor demand decision on the already optimal intermediate input goods prices. Using Shepard's lemma, level 1 firms' labor demand reads as

$$\frac{\partial c_i(q, r; z)}{\partial q_i(z)} = B\zeta a_i(z)(q_i a_i(z))^{\zeta-1} r_i^{1-\zeta} . \quad (7)$$

The economy's total labor demand can be found by aggregating industry labor demand over the whole continuum of active industries

$$L_i(1 - u_i(\theta_i)) = \int_{z_i}^{\bar{z}_i} B\zeta \left[\frac{r_i}{q_i a_i(z)} \right]^{1-\zeta} a_i(z) x_i(z) dz , \quad (8)$$

where \bar{z}_i and z_i represents the upper and lower bound of industries where the respective country has a comparative advantage. Intermediate goods' prices q are deter-

mined on level 2 and depend on the equilibrium market tightness. Equation (2) allows us to simplify the Labor Market Condition (*LMC*) such that the equilibrium depends only on the endogenous parameters z and θ_i as well as other exogenous parameters and reads as

$$L_i(1 - u_i(\theta_i)) = \int_{\underline{z}_i}^{\bar{z}_i} \zeta \frac{\varphi(z) E \left\{ (1 - \beta) - c \left(\beta \theta_i + \frac{\eta + \lambda}{m(\theta_i)} \right) \right\}}{\{(1 - \beta) b_i\}} dz . \quad (9)$$

The standard Pissarides (2000) assumption that each firm employs one worker links level 2 firms' demand for intermediate goods in (9) and level 2 labor demand which is equal to the number of firms. The specialization pattern under free trade is ex-ante unknown and depends on the unit cost schedule over all industries. The mass of one single industry approaches zero in the continuous scenario. A sensible interpretation therefore demands the computation of the mass of a certain range of industries within the whole continuum. The consumption share for industry output in z is constant and equalized over the whole continuum, which allows us to solve the integral in (9).

Lemma 2. *Labor markets are in equilibrium if labor demand equals labor supply. The LMC conditions therefore pin down equilibrium market tightness, wages, and unemployment. The equilibrium is well-defined as there exists a unique combination of home and foreign market tightness such that both LMC curves are fulfilled given the cutoff z^* .*

Proof. Let Γ_L denote the left, Γ_R the right hand side of the labor market clearing condition. The left hand side of both conditions has its origin at zero and converges to an upper bound. The intuition is the following. Let θ_i go towards zero. Wages would approach zero, whereas unemployment would go towards infinity such that the left hand side of the LMC curve has its origin in zero and converges towards full employment. The right hand side is also well behaved. Labor demand is positive for θ_i approaching zero and decreases in θ_i . An increase in θ_i triggers an increase in intermediate input goods' prices, which in turn reduces demand for the intermediates. Thus, there is a unique solution for the LMC curve determined by the intersection of Γ_L and Γ_R . \square

3. General Equilibrium

The general equilibrium requires a framework that pins down the endogenous parameters. To close the model income is normalized to unity and determined by adding up world factor payments to workers in and outside of the unemployment pool given by

$$E = L_d(1 - u_d)w_d + r_dK_d + L_f(1 - u_f)w_f + r_fK_f + UB , \quad (10)$$

where $UB = u_dL_db_d + u_fL_fb_f$ is aggregate unemployment benefits paid to the fraction of jobless workers searching for a job. Capital rentals are determined using the Cobb Douglas shares and the capital market clearing conditions

$$r_dK_d = \frac{1 - \zeta}{\zeta} L_d(1 - u_d)q_d , \quad (11)$$

$$r_fK_f = \frac{1 - \zeta}{\zeta} L_f(1 - u_f)q_f . \quad (12)$$

Interest rates are such that capital markets are in equilibrium. The equilibrium then depends on 6 endogenous variables: 2 equilibrium market tightness, capital return in the foreign country, capital return in the home country, one cutoff that pins down the trade pattern between both countries, and income. Without loss of generality we can use world income as numeraire. To close the model one still has to solve for the optimal free trade pattern.

Corollary 1. *The trade pattern between both countries hinges on one unique cutoff $z^* \in (0, 1)$ satisfying*

$$p_d(z^*) = p_f(z^*) \Leftrightarrow c_d(\theta_d; z^*) = c_f(\theta_d; z^*) . \quad (13)$$

4. Comparative statics analysis

For the comparative statics analysis we focus on two closely related scenarios. Firstly, we analyze how footloose capital flows triggered by differences in international capital returns affect equilibrium unemployment. For this particular scenario interest rates are endogenously determined. Secondly, we turn to the implications of labor market insti-

tutional reforms on capital flows. For this second exercise interest rates are exogenous by assumption. Notice, that the comparative statics presented are closely related to that presented in the companion paper Schmerer (2010) where we already derived those effects for low and high skill workers. We therefore briefly state the main implications without going into more details.

4.1. The effects of *FDI* on equilibrium market tightness.

FDI in the form of capital inflows and outflows necessarily induce interest rate readjustments so that the capital clearing conditions are in equilibrium again. Capital inflows for instance reduce the scarcity of capital and thus precipitate a reduction in interest rates, which has a decreasing effect on unit costs. Given that all other factor prices remain constant, the unit cost function shifts down associated with lower final good prices over the whole continuum. The opposite happens in the country that loses capital due to a relatively lower interest rate.

The trade pattern is no longer optimal and the new intersection of the domestic and the foreign unit cost schedules is pinned down by $z^{*'} > z^*$. The range of active industries contracts in the *FDI-out* economy and expands in the *FDI-in* economy. This implies that the former labor market equilibrium is not optimal any more: unemployment, wages and the equilibrium market tightness have to adjust.

In the following I distinguish between the adjustments at the extensive and intensive margin. At the extensive margin some industries die, which gives rise to a reduction in labor demand on the aggregate level. At the same time the adjustments of capital costs also directly affect the equilibrium by triggering a substitution between capital and labor.

Proposition 1. *FDI outflows result in capital cost adjustments. Firms' labor demand increases at the intensive margin due to higher capital costs triggering a substitution effect. At the extensive margin the increase in the cutoff destroys all jobs associated with industries formerly belonging to the sending country. The opposite pattern applies for the FDI-receiving country.*

Proof. To see this one has to derive the first derivative of the right hand side of the LMC curve with respect to the cutoff z^* , which is positive for the receiving and negative for

the sending country, translating into job creation (*FDI-in* country) and job destruction (*FDI-out* country) at the extensive margin. Note that the distinction between the case where z^* is the upper or lower bound active industries is necessary. Suppose for instance that the home country's fixed bound of active industries is the upper bound $\bar{z}_d = 1$ so that its lower bound is z^* . A contraction of the range of active industries in the respective country would mean that z^* is increasing. The first derivative of Γ_R with respect to z^* would therefore be negative. The same logic applies for the foreign country with one important difference being that z^* is now the upper bound of active industries whereas the lower bound is pinned down by $\underline{z}_d = 0$, giving rise to the fact that the first derivative of Γ_r in the foreign economy is positive.

For adjustments at the intensive margin it is enough to see that industry labor demand for both type of workers goes up when the interest rate increases.

In order to restore equilibrium labor supply must adjust too. Since labor demand in the *FDI-out* country decreases at the extensive margin, a higher rate of unemployment is needed to restore equilibrium. Thus, the equilibrium market tightness must fall, wages go down and unemployment goes up. This in turn boosts labor demand on the individual industry level and strengthens the increase in labor demand on the intensive margin. Income adjustments do not matter in my setup since income is set as numeraire. A formal proof can be found in the Appendix. \square

4.2. Changes in labor market institutions

Proposition 2. *Changes in institutions that benefit the workers by increasing their wages due to higher bargaining power β or higher unemployment benefits b triggers capital outflows.*

Institutional changes benefiting the workers increase their wages. Suppose that cut-off z^* and the equilibrium market tightness remain constant. An increase in unemployment benefits or the bargaining power of workers for instance result in higher equilibrium wages, provided all other variables remain constant. The effect of positive institutional changes is therefore identical to an increase in the interest rate and the unit cost schedule shifts upwards so that the former equilibrium cutoff is no longer optimal and must adjust, too. Furthermore, capital allocation is no longer optimal since interest rates remain fixed, resulting in capital flows between countries in order to restore

equilibrium. The intuition is straightforward. A contraction of active industries without adjustments in the interest rate sets capital free which will be shifted abroad where capital is needed due to the expansion of production. Unemployment and wages must adjust until the new equilibrium is reached. These spillover effects stem from the interdependency between countries connected via trade. However, a new capital market clearing condition is necessary to solve for the new equilibrium. Again we use Shepard's lemma to derive industry level capital demand which reads as

$$\frac{\partial c_i(z)}{\partial r_i} = B(1 - \zeta)(q_i(z)a_i(z))^\zeta r_i^{-\zeta} . \quad (14)$$

Aggregating industry level capital demand over all active industries yields

$$K_i = \int_{\underline{z}_d}^{\bar{z}_d} k_i(z)x(z)dz , \quad (15)$$

similar to the solution for the LMC curve we use equation (14) and (2) in (15) to obtain

$$K_i = \int_{\underline{z}_d}^{\bar{z}_d} B(1 - \zeta)(q_i(z)a_i(z))^\zeta r_i^{-\zeta} x(z)dz \quad (16)$$

$$= \int_{\underline{z}_d}^{\bar{z}_d} \frac{B(1 - \zeta)\varphi(z)E(q_i(z)a_i(z))^\zeta r_i^{-\zeta}}{B(q_i a_i(z))^\zeta r_i^{1-\zeta}} dz \quad (17)$$

$$= \int_{\underline{z}_d}^{\bar{z}_d} (1 - \zeta)\varphi(z)E[r_i^{-1}] dz . \quad (18)$$

Compare this solution to the aggregate capital market clearing conditions used to endogenize the interest rates in both countries. It is easy to show that both conditions are equal by simply combining the labor and capital market clearing conditions via equations (11) and (12). With endogeneous interest rates the effects of an institutional change on capital is unambiguous and depends solely upon the adjustments at the extensive margin. World capital endowments are fixed. Using the Leibniz rule we can derive the first derivative of the right hand side with respect to the cutoff z^* which is negative for the contracting, and positive for the expanding economy. The effect is thus unambiguous and we therefore neglect the calibration.

Table 1: Parameterizations of the model

Parameters used for the simulation		
<u>Parameter</u>	<u>Description</u>	<u>Value</u>
<u>Labor market parameters</u>		
λ	Job destruction rate	0.04
α	Elasticity of the matching function	0.50
b	Unemployment benefits	0.15
m	Scale parameter of the matching function	1.1
c	Vacancy posting costs	1.1
<u>Industry Input Coefficients</u>		
α_d	Constant of the input coefficient curve (domestic)	1.9
α_f	Constant of the input coefficient curve (foreign)	0.6
γ_d	Slope of the input coefficient curve (domestic)	0.1
γ_f	Slope of the input coefficient curve (foreign)	2.9
ζ	Cobb Douglas share (stage 1 production)	0.50
<u>Endowment</u>		
L_d	Labor force (domestic)	0.5
L_f	Labor force (foreign)	0.5
K_d	Kapital stock (domestic)	6
K_f	Kapital stock (foreign)	4

5. Numerical illustration

Purpose of this simulation exercise is to solve the remaining ambiguity arising due to the countervailing effect of FDI on labor demand at the intensive and extensive margin. Table (1) summarizes all parameters used for the benchmark calibration where labor and capital markets are in equilibrium so that the foreign interest rate is equal to the domestic interest rate. We then simulate simultaneous capital flows from the foreign to the home country triggered by differences in foreign and home capital returns that attract FDI away from Foreign. To calibrate the benchmark we target the unemployment rate equal to 7 percentage points. Besides unemployment we exploit the interest rates as targets for the calibration. Parameters related to the labor market are set according to the empirical evidence found in the relevant search and matching literature, whereas product market related parameters are set somewhat arbitrarily. The only anchor we have for the product market parameters is the interest rate.

Product market related parameters. Calibrating the product market related parameter remains a difficult task since no reliably data exists. We set the parameters of the labor requirement curves so that Home has a comparative advantage in industries located closer to the upper bound of the continuum. The α and γ parameters of the intermediate input requirement curves are set as required to secure the existence of a unique cutoff within the set of feasible z . The Cobb-Douglas share on level 1 is set equal to $\zeta = 0.5$ and equilibrium interest rates are targeted to approach 2 percentage points.

Labor market related parameters. Calibrating the labor market parameters is possible due to numerous studies that shed light on the search and matching framework from an empirical perspective. Most important, Hall (2005) estimates the U.S. equilibrium market tightness at 0.5. Petrongolo and Pissarides (2001) find that setting the elasticity of the matching function equal to 0.5 is a good approximation for the U.S. economy. The equilibrium market tightness, the elasticity of the matching function, and the monthly job destruction rate equal to $s = 0.034$ pin down the scalar of the matching function at $m = 0.64$ so that $u_{US} = 7$ percentage points. Unemployment benefits b and search costs c are set arbitrarily and do not influence the outcome of the calibration.

Endowment. Given all other parameters discussed we set endowments so that the labor market and the capital market equilibrium conditions are in equilibrium, the rate of unemployment lies around 7 percentage points, whereas the interest rates are about 0.02. We find that $L_d = 0.5$, $L_f = 0.5$, $K_d = 4.6$, and $K_f = 4.4$ yields outcomes for the endogenous variables in line with those targets and in line with the calibration of the other labor market parameters.

Simulation results. Figure (1) shows the simulation results. Foreign and home capital stocks in the initial point ($FDI=0$) are such that the interest rates are not in equilibrium. Starting from that point we simulate symmetric capital flows from the foreign to the domestic country until the benchmark equilibrium is reached. At $FDI = 0$ the initial capital stocks are $K_d = 3$ and $K_f = 6$. Given the parameters presented above the Home interest rate is higher than the foreign interest rate, which attracts capital in form of FDI. Capital flows from Foreign to Home up to the point $FDI = 1.6$, where both the capital and the labor market are in equilibrium as $r_d = r_f$ and unemployment is approximately equal to 7 percentage points matching the equilibrium market tightness $\theta = 0.5$. The assumption that FDI-flows are symmetric gives rise to a benchmark equilibrium associated with $FDI = 1.6$ where the domestic capital stock increased from 3 to 4.6, and the foreign capital stock decreased from 6 to 4.4. Unemployment, wages, and interest rates are equal in both countries due to symmetric calibration of the labor market parameters. In Foreign, the adjustments at the intensive margin are not enough to outweigh the foreign increase in labor demand at the extensive margin. Wages have to decrease and unemployment has to increase in order to restore labor market equilibrium. The opposite happens in the receiving home country. As indicated in the upper panel of Figure (1) the home equilibrium market tightness goes up associated with a higher wage and thus a lower equilibrium unemployment rate as can be seen in the lower panel of Figure (1). The magnitude of the effect is rather weak. Symmetric capital flows equal to $FDI = 1.6$ reduce equilibrium unemployment in the receiving country by approximately 0.5 percentage points. The sending country sees its rate of unemployment increasing by exactly the same amount. Those results are in line with the outcome of the empirical analysis in the next chapter. Using OECD data we find that a one-standard-derivation of net-FDI (in- minus outward FDI) reduces unemployment by a robust 0.5 percentage points.

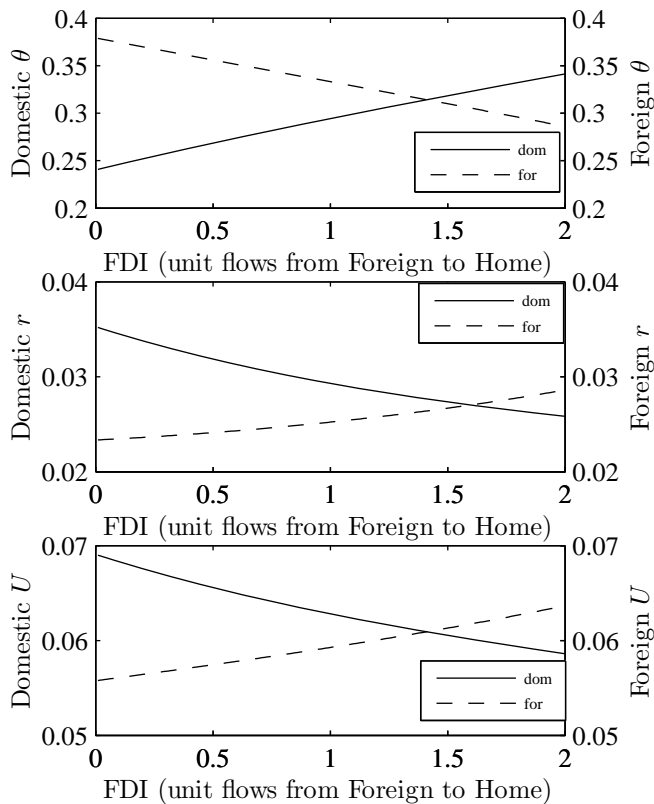


Figure 1: Numerical illustration

6. Empirical evidence

For the second part of this study, data from Bassanini and Duval (2005) and the UNCDAT is used to test the main implications of the model presented in the theory section. First, the model predicts that inward-FDI is associated with a lower rate of equilibrium unemployment, whereas outward-FDI tends to increase unemployment. Second, improvements in labor market institutions that benefit the workers by increasing their rights and/or wages tend to trigger capital outflows. This result stems from the fact that institutional changes in favor of the workers reduce firms competitiveness in some of the industries close to the initial cutoff through their direct and indirect effects on wages. A successful test for those findings will be presented in this chapter, where we use panel data on in- and outward FDI, aggregate and skill-specific unemployment, labor market institutions and other control variables for 19 OECD countries in order to

analyze the relationship highlighted in the theory section. Theory does not allow for simultaneous capital in- and outflows. This issue is addressed by constructing FDI-net stocks/flows as difference between FDI-in and FDI-out relative to GDP. Negative signs for FDI net flows/stocks indicate that a net-increase in capital-imports is associated with a reduction in unemployment. Two major concerns remain: Unemployment fluctuates with the business cycle and the analysis might be biased due to omitted variables. I address the first problem by controlling for the output gap measuring the difference between GDP and its long run trend as well as other macroeconomic shocks. Five-year averages were taken in a second step, which purges short run fluctuations from the data. The second problem is by far more involved and addressed by including various control variables that capture labor market institutions, as well as dummy variables to control for country and time specific effects. Since FDI might be endogenous to unemployment, the time dimension of the data is used to construct instruments for the diff-GMM regressions, which allows to tackle the endogeneity problem by treating FDI as endogenous.⁵

The empirical setup is closely related to the empirical strategy in Felbermayr et al. (2009) or Dutt et al. (2009) both of which focus on trade liberalization and aggregate unemployment.

6.1. Empirical strategy and data

Empirical strategy. Inspired by numerous labor market studies that analyze the effects of institutional changes on labor market outcomes we estimate a linear model with total unemployment as the dependent variable to shed light on proposition 1 from an empirical perspective. The model reads as

$$u_{it} = \alpha + \beta \times FDI_{it} + \gamma_1 \times LAB_{it} + \gamma_2 \times CON_{it} + CCC_i + YYY_t + \epsilon_{it} , \quad (19)$$

where α is a constant, FDI is the variable of interest measuring FDI-net intensity as the difference between in- and outward FDI relative to GDP, LAB contains various labor market institutional variables, where Basanini and Duval provide measures on the

⁵The requirement on diff-GMM regressions are rather demanding and not always fulfilled. Several test statistics permit the evaluation of the GMM results. Sys-GMM results are not presented since it produces instruments that are not valid due to the over identification problem.

replacement rate, tax wedge, employment protection, and union density. Additional control variables captured by *CON* include product market regulations⁶, and the output gap to cope with short run fluctuations. The panel structure of the data facilitates purging the regressions of country and time invariant effects by including dummy variables in the regressions.

The second proposition that states that changes in labor market institutions affect FDI flows is tested using the same empirical strategy but with FDI replacing unemployment as the dependent variable

$$FDI_{it} = \alpha + \gamma_1 \times LAB_{it} + \gamma_2 \times CON_{it} + CCC_i + YYY_t + \epsilon_{it} , \quad (20)$$

The variables of interest when testing the interaction between labor market institutions and FDI are those measuring the direct and indirect effect of institutional changes on wages. The preferred estimator in both parts of the analysis is a consistent fixed effects estimator including additional time dummies to control for trends common to all countries. To show that the results do not hinge on the estimation technique, additional random effects, and feasible least square models are employed. In a last step, the endogeneity issue is addressed by use of a diff-GMM estimator where the *LAB* variables are treated as endogenous.

Generally speaking, the data dimension necessitates five-year averages in order to run diff-GMM regressions, which also further reduces the impact of short run fluctuations. One problem is that the data has a relatively larger cross-sectional than time-dimension. Usually the instruments perform badly when $T > C$, which is due to too many instruments. Obviously, this requirement is not fulfilled by the original Bassanini and Duval data set which covers observations from 1983 - 2003 for 20 OECD countries. Five-year averages ease this problem by reducing the number of instruments and structural breaks in the data. However, notice that the structure of the data is still not optimal indicated by the number of instruments and the Sargan test statistics for diff-GMM regressions based on the full sample, but the problem disappears once we take five-year averages. I also skip sys-GMM since the additional level equation would further increases the instrument count and drive the test on overidentification towards a p-value equal to 1.0.

⁶As shown by Felbermayr, and Prat (2009) product market regulations have an significant impact on unemployment.

Data. To bring the model to the data we use measures from the OECD, UNCDAT, and WDI. The dependent variable in part A is OECD total unemployment including 15 - 64 years old male and female observations. As additional robustness check we use skill-specific unemployment rates from the World Development Indicators to decompose aggregate unemployment into its primary-, secondary-, and tertiary-educational components. The purpose of this exercise is to show the complementarity between both skill groups respective of the effects of FDI on unemployment.⁷ To construct skill-specific unemployment rates we multiply total unemployment from the World Development Indicators with a variable measuring the fraction of total unemployment with primary, secondary, and tertiary education. To transfer the data into skill-specific rates we multiply the result with the ratio of total workers relative to the number of workers with respective education in order to obtain the number of workers unemployed relative to the number of workers available within that skill group. However, one major drawback is the sparse data availability ranging from 1994 - 2004 with lags.

The variable of interest in part A is FDI-net stocks and flows constructed using measures on in- and outward FDI from the UNCDAT database. FDI-net is measured as the difference between inward-FDI and outward-FDI relative to GDP. FDI includes transactions of firms from foreign countries holding a share of at least 10% in a domestic company. Inward FDI is an investment from abroad in the reporting country, whereas FDI-out measures FDI from the reporting country to other countries. FDI stocks and flows are measured in current U.S. dollars so that a measure for GDP from the Penn World Table can be used to construct FDI-net intensities in order to create a comparability across countries. Portfolio investment assets and real openness, both in U.S. dollars relative to GDP, are included as additional control variables to proxy financial integration and globalization, where the data was taken from the International Monetary Fund and the World Bank.

Various measures of labor market institutions available through the OECD were exploited to reduce the omitted variable bias caused by other unobserved variables that drive unemployment. Bassanini and Duval provide and discuss a data set that contains the most important variables. We control for tax wedge, replacement rate, employment

⁷Theory in Schmerer (2010) requires low and high skill unemployment wherefore we classify unemployed with secondary and tertiary education as high skill-specific unemployment. Moreover, theory predicts that both skill groups are equally affected by FDI. This stems from the Leontief production function, which is in line with Feenstra and Hanson (1996, 1997) model where high and low skill inputs are used according to a Leontief production function.

protection (EPL), and union density. Unfortunately the OECD stopped updating those variables so that labor market institutions are available for the period 1983 - 2003 only and therefore also determine the time dimension of our sample.

Part B of the analysis focuses on the role of labor market institutions by including them as variables of interest in regressions with FDI as the dependent variable. Two variables are available that directly measure how labor market institutions affect wages: the replacement rate and the tax wedge. The replacement rate is a measure for compensation paid to workers after losing their job and tax wedge measures taxation on wages by computing the difference between wages paid by employers and wages earned by employees. Moreover, union density and employment protection are also potential drivers behind FDI-flows through their indirect effects on the labor market flexibility and thus through their indirect effects on wages. Union density is a variable on the percentage share of workers associated with unions which is also often used as a proxy for the workers' bargaining power, and EPL measures the stringency of employment protection legislation indirectly affecting wages by protecting workers with productivity below their marginal product from being expelled. PMR is a measure of the stringency of product market regulation in the respective country.

We will distinguish between employment protection for regular and temporary contracts, and for two different measures for union density when institutional spillover effects thrust into the spotlight of our analysis.

An output gap measure and various macroeconomic shocks purge short run fluctuations from the data and thus help to reduce the omitted variable bias. A total factor productivity shock is constructed as the derivation of total factor productivity from its trend using a Hodrick-Prescott filter, terms of trade shocks that measure the relative price of imports weighted by the share of imports in GDP, real interest rate shocks that measure the difference between the 10-year nominal government bond yield and the annual change in the GDP deflator, as well as labor demand shocks constructed as the logarithm of the labor share in business sector GDP purged from the short-run influence of factor prices.⁸ The output gap variable measures the difference between actual and potential GDP as percentage of potential output.

⁸Data description taken from Basaninin and Duval (2010).

6.2. Results

According to theory, the predicted sign of the *net-FDI* coefficient is negative when regressing upon unemployment.

Table 2: Aggregate unemployment and FDI-net

<i>Dependent variable: Total unemployment</i>							
<i>Variable of interest: FDI-net (FDI-in minus FDI-out relative to GDP)</i>							
	I	II	III	IV	V	VI	VII
	FE	FE	FE	FE	FE	FE	FE
FDI-net	-0.048** (0.018)	-0.041** (0.019)	-0.030** (0.012)	-0.029** (0.012)	-0.045*** (0.016)	-0.033* (0.018)	-0.026 (0.023)
Portfolio investment	-0.570*** (0.121)			-0.145 (0.115)		-0.005 (0.156)	0.186 (0.134)
Openness			-0.156*** (0.046)	-0.131** (0.058)		-0.151** (0.058)	-0.128* (0.064)
EPL					-1.281 (1.384)	-1.182 (1.400)	-1.281 (1.031)
Union density					-0.055 (0.064)	0.001 (0.061)	-0.007 (0.063)
PMR					0.297 (0.618)	0.636 (0.644)	0.659 (0.576)
Replacement rate					-0.031 (0.043)	-0.025 (0.050)	-0.053 (0.043)
Tax wedge					0.315*** (0.098)	0.240** (0.112)	0.145* (0.080)
Output gap		-0.566*** (0.092)	-0.552*** (0.087)	-0.577*** (0.085)	-0.616*** (0.061)	-0.591*** (0.055)	-0.786*** (0.060)
R-square	0.348	0.509	0.578	0.584	0.594	0.663	0.730
N	428	456	456	428	386	368	338

Robust standard errors in parentheses, *significant at 10%, ** significant at 5%, *** significant at 1%. Data is available for 19 OECD countries. Time dummies included in all regressions, except of (I). Macroeconomic shocks are included in regression (VII).

Regressing labor market institutions on FDI similarly requires negative signs for the *LAB* variables. Theory predicts that *net-FDI* inflows tend to lower the rate of unemployment due to a reallocation of industries, which causes job creation in the receiving

and job destruction in the sending country. Thus, *net-FDI* receiving countries should have relatively lower unemployment rates and an increase in *net-FDI* over time is expected to lower equilibrium unemployment rates. For part B of the analysis the sign for the labor market institutional variables is expected to be negative since one of the predictions derived from theory states that improvements of the workers' situation results in higher wages and thus trigger capital outflows by rendering investments to foreign countries more lucrative due to relatively lower labor costs.

Indeed, the data reveals exactly the same pattern as theory suggests. Regressing *FDI* on unemployment yields a negative and highly significant coefficient for *net-FDI*. Regressing labor market institutions on *net-FDI* also reveals the right coefficients for the institutional variables of interest. In the following, results are discussed in more detail.

Benchmark results Table (2) presents the benchmark regression results for the preferred regression model, which is a consistent fixed effects model. The full set of available observations is employed without averaging the data in order to reduce the fluctuations in the business cycle. However, the advantage is that this leaves us more than 400 observations for 19 OECD countries, available for the period 1983-2003. Purging the regressions from fixed effects allows us to capture the changes on the individual country level. In regression (I) the focus lies on the measures FDI and portfolio investment, without controlling for any other shocks, institutional variables, business cycle effects, or the time trend. The variable of interest is *net-FDI*. Portfolio investment is a proxy for financial integration and the dependent variable is total OECD unemployment. We obtain a significant FDI coefficient in regression (I) where we omit potential unemployment drivers as short-run macroeconomic shocks, the business cycle, or labor market regulations. The relation is rather strong and likely reflects a spurious correlation driven by the variation in the business cycle. Portfolio investment is also negative and highly significant. We additionally include time dummies and the output gap in column (II). Regression (III) contains controls for the output gap and openness as additional control for globalization. In regression (IV) the whole globalization control bundle is included. All regressions reveal the same picture. FDI-net is negative and turns out significant in all regressions. Portfolio investment is less robust and becomes insignificant once we control for the business cycle. As in Felbermayr, Prat, and Schmerer (2009) openness

in regression (III) and (IV) has the expected sign and is also highly significant. We can also observe a massive reduction for the FDI-net coefficient once the business cycle fluctuations are controlled for by including the output gap variable, which indicates a huge impact of the business cycle on unemployment. Regression (V) and (VI) compares the outcome of regressions where we control for labor market institutions (V), and where we additionally include the entire set of globalization controls in (VI). Comparing regression (II) and (V) reveals another interesting finding. Both coefficients for the output gap and for FDI-net are higher when we control for labor market institutions. Respectively, the magnitude of the effect of FDI is also stronger in (VI) than in (IV), but the globalization measures also have a huge impact and further reduce the magnitude of the effects of net-FDI. In regression (VII) all controls and macroeconomic shocks are included which yields insignificant results for net-FDI.

To conclude this first part of benchmark regression discussion, all regressions except of (VII) yield significant and negative coefficients for the net-FDI measures. The sign of the effect is statistically different from zero and robust, but the coefficient also reveals a relatively weak magnitude of the effect. Moreover, the magnitude highly depends upon whether we control for the business cycle or not. Another problem is the structure of the data, which neither allows us to tackle potential endogeneity problems using GMM, nor does it allow to purge the data from short run effects in an adequate way. The Sargan test on over identification would yield a p-value exactly equal to zero, which means that the instruments are simply not valid. In the second part we therefore focus on regressions where 5-year averages were taken. The results can be found in Table (3). Regression (I) only includes net-FDI and indicates that a one standard deviation increase in *net-FDI* reduces unemployment by roughly 0.8 percentage points. Including the institutional controls increases the magnitude to a reduction in unemployment equal to 1 percentage point. Controlling for financial integration reduces the significance in net-FDI, whereas additionally controlling for openness restores its significance. Next, more of our attention is paid to the endogeneity problem by performing various diff-GMM setups. The setup in (V) treats net-FDI and the output gap as endogenous. The performance of the instruments is rather good compared to the results obtained for the non-averaged data. The test on first and second order autocor-

Table 3: Aggregate unemployment and FDI-net (5-year averaged data)

<i>Dependent variable: Total unemployment</i>								
<i>Variable of interest: FDI-net (FDI-in minus FDI-out relative to GDP)</i>								
	I	II	III	IV	V	VI	VII	VIII
	FE	FE	FE	FE	DIFF-GMM	DIFF-GMM	DIFF-GMM	FGLS
FDI-net	-0.039*	-0.049***	-0.026	-0.043**	-0.114**	-0.139***	-0.087**	-0.034**
	(0.019)	(0.014)	(0.026)	(0.019)	(0.056)	(0.049)	(0.041)	(0.014)
port			-0.440*	0.203	1.767**	1.533**	1.547**	0.133
			(0.241)	(0.283)	(0.754)	(0.632)	(0.691)	(0.201)
Openness				-0.175**	-0.420***	-0.263**	-0.422***	-0.199***
				(0.078)	(0.131)	(0.132)	(0.114)	(0.038)
Lag dep. var.					0.565**	0.475*	0.549**	
					(0.221)	(0.280)	(0.221)	
Replacement rate		-0.034	-0.008	-0.027	-0.083	-0.079	-0.079	-0.006
		(0.046)	(0.061)	(0.054)	(0.052)	(0.055)	(0.051)	(0.025)
Tax wedge		0.376***	0.286**	0.296**	0.090	0.179*	0.072	0.191***
		(0.109)	(0.108)	(0.117)	(0.100)	(0.104)	(0.106)	(0.062)
EPL		-0.890	-0.551	-0.920	-0.569	-0.937	-0.447	-0.682
		(1.356)	(1.517)	(1.453)	(1.261)	(1.178)	(1.221)	(0.511)
Union density		-0.069	0.008	0.007	-0.085	-0.155**	-0.036	0.007
		(0.056)	(0.054)	(0.056)	(0.084)	(0.076)	(0.074)	(0.037)
PMR		0.431	0.651	0.760	0.142	0.166	0.198	0.845***
		(0.645)	(0.632)	(0.690)	(0.668)	(0.672)	(0.658)	(0.291)
Output gap	-0.710***	-0.649***	-0.595***	-0.583***	-1.102***	-1.139***	-1.006***	-0.616***
	(0.117)	(0.093)	(0.083)	(0.075)	(0.190)	(0.214)	(0.194)	(0.064)
R-square (within)	0.684	0.625	.	.	.	.	.	.
AR (1)	.	.	.	.	0.037	0.078	0.032	.
AR (2)	.	.	.	.	0.417	0.212	0.522	.
Sargan OID-test	.	.	.	.	0.464	0.167	0.238	.
N	89	89	89	89	69	69	69	89

Robust standard errors in parentheses, *significant at 10%, ** significant at 5%, *** significant at 1%. Data is available for 19 OECD countries. time dummies included in all regressions. Fixed effects preferred for the benchmark specification according to the Hausman test. FDI-net and output gap treated as endogenous in (V). In (VI) we additionally treat openness as endogenous. In (VII) we treat FDI-net, openness, output gap, and portfolio investments as endogenous.

relation of the instruments with the error term yields p-values equal to 0.037 and 0.417, and the Sargan test p-value is higher than 0.1 but below 0.5, which indicates that there is no overidentification. However, the globalization measures are also potential sources for endogeneity issues, which is tackled in regression (VI) where we treat openness, net-FDI and the output gap as endogenous, or in (VII) where we treat FDI, openness, the output gap, and portfolio investment as endogenous. All setups yield the same robust finding. FDI-net and openness is negative and significant, and we also find that portfolio investment is positive and significant which further supports our story by indicating that more financial market integration with investors holding foreign portfolio assets

having the same effects as FDI-outflows. However, the finding is interesting but unfortunately it is not robust and only appears in the GMM regressions. FGLDS in (VIII) also yields comparable results.

Table 4: FDI-net stocks and labor market institutions (5-year averages)

<i>Dependent variable: FDI-net</i>				
<i>Variable of interest: Labor Market Institutions</i>				
	I	II	III	IV
	FE	FE	FE	FE
EPL (regular contracts)	-10.141** (3.909)	-18.460*** (5.939)	-15.078*** (5.182)	-20.419*** (4.571)
EPL (temporary contracts)	-2.128 (2.090)	-3.376 (2.576)	-3.110 (2.592)	-3.304 (2.154)
Union density	-0.351 (0.235)	-1.009** (0.357)	-0.774*** (0.215)	-1.039*** (0.355)
PMR	-3.075 (5.881)	-2.347 (4.612)	-1.941 (4.728)	-1.772 (4.208)
High union coverage	-26.565*** (8.799)			
Replacement rate		-0.412 (0.519)		-0.565 (0.419)
Tax wedge		0.524 (0.751)		1.144** (0.467)
Wage distortion			-0.634 (0.375)	
Openness				-1.010*** (0.349)
Portfolio investment				8.850*** (1.668)
Output gap	1.369 (0.869)	1.342 (0.959)	0.585 (0.712)	0.651 (0.666)
R-squared	0.278	0.273	0.305	0.599
N	96.000	93.000	96.000	89.000

Robust standard errors in parentheses, *significant at 10%, ** significant at 5%, *** significant at 1%. Data is available for 19 OECD countries.

In a last step the role of labor market institutions is analyzed by replacing the dependent variable unemployment with net-FDI in order to shed light on the role of labor market institutions. Results are reported in Table (??). Potential candidates that might lead to an increase in FDI outflows relative to inflows are employment protection, union density, and all kind of wage distortions, which potentially distract investments from Home. We disentangle employment protection into EPL_r which measures the protection for regular contracts, and EPL_t for temporary contracts. A dummy for high union coverage is included in some (I), where we find negative coefficients for all variables of interest. However, only high union coverage and employment protection for regular contracts turn out to be significantly different from zero. Different setups with different controls were tried, and all setups yield the same robust finding that high union activity and employment protection are negatively associated with FDI inflows relative to FDI-outflows. Replacement rate and tax wedge measures are included in (II) but both are not significant. In (III) we try to combine the replacement rate and tax wedge measure as wage distortion. The coefficients are again insignificant. Finally in (IV) we control for all variables of interest and the globalization controls openness and financial market integration. However, the measures on the direct effect of institutions on the workers' wages remain insignificant but employment protection for real contracts and union density is negative and highly significant in all regressions.

6.3. Additional robustness checks.

Table (5) reports the results for the additional robustness checks where we focus on *net-FDI* by excluding openness and portfolio investment. The dependent variable is total OECD unemployment. In a first step we analyze the omitted variable bias caused by neglecting potential unemployment drivers as short-run macroeconomic shocks, the business cycle, or labor market regulations. We additionally include time dummies In column (II) , and in regression (III) we also control for business cycle effects. Notice that five-year averages were taken in order to derive long-run variables.

The coefficients in all regressions are statistically different from zero and negative, but the magnitude of the effect is highly dependent upon whether we control for the business cycle or not. Regression (I) indicates that a one-standard deviation increase in

Table 5: Aggregate unemployment and FDI-net stocks

<i>Dependent variable: Total unemployment rate</i>						
<i>Variable of interest: FDI-net (FDI-in minus FDI-out in stocks relative to GDP)</i>						
	I	II	III	IV	V	VI
	FE	FE	FE	FE	FE	FE
FDI-net	-0.061*	-0.072***	-0.043**	-0.050***	-0.049***	-0.047***
	(0.03)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)
Replacement rate				-0.025	-0.034	-0.031
				(0.05)	(0.05)	(0.05)
Tax wedge				0.383***	0.375***	0.355***
				(0.11)	(0.11)	(0.11)
EPL				-0.577	-0.889	-0.920
				(1.28)	(1.40)	(1.40)
Union density				-0.065	-0.068	-0.073
				(0.05)	(0.06)	(0.06)
PMR					0.429	0.444
					(0.70)	(0.73)
TFP						20.190
						(16.40)
Output gap			-0.745***	-0.652***	-0.648***	-0.733***
			(0.12)	(0.10)	(0.10)	(0.09)
R-squared	0.086	0.267	0.522	0.603	0.607	0.612
Observations	91	91	91	91	91	91
Time dummies		x	x	x	x	x
Country dummies	x	x	x	x	x	x

Robust standard errors in parentheses, *significant at 10%, ** significant at 5%, *** significant at 1%. Data is available for 19 OECD countries. Country dummies included in all regressions, time dummies included in all regressions except in I.

net-FDI reduces unemployment by roughly 1 percentage point. Additionally including time dummies reveals a downward bias caused by omitting trends from the data. Conversely, regression (III) shows that omitting business cycle effects creates an upward bias in the results. The results obtained by inclusion of the output gap variable yields results that suggest that a one-standard deviation of *net-FDI* reduces unemployment by a robust 0.56 percentage points. Including further control variables as labor market institutions or shocks also yields coefficients that indicate a relationship between *net-FDI* and unemployment of the same magnitude. We conclude this first discussion of the benchmark results by comparing the magnitude of the effect of FDI on unemployment to the effects of a one-standard deviation increase in the output gap that reduces unemployment by 1.8 percentage points. The benchmark regression results therefore support theory, but the magnitude of the effect is rather weak.

Table 6: Aggregate unemployment and FDI-net flows

<i>Dependent variable: Total unemployment rate</i>						
<i>Variable of interest: FDI-net (FDI-in minus FDI-out in flows relative to GDP)</i>						
	I	II	III	IV	V	VI
	FE	FE	FE	FE	FE	FE
FDI-net	-0.374 (0.27)	-0.340 (0.23)	-0.241 (0.18)	-0.269* (0.15)	-0.276* (0.15)	-0.306** (0.14)
Replacement rate				-0.005 (0.05)	-0.017 (0.05)	-0.016 (0.05)
Tax wedge				0.368*** (0.11)	0.358*** (0.11)	0.325*** (0.10)
EPL				-0.510 (1.26)	-0.957 (1.33)	-1.096 (1.37)
Union density				-0.061 (0.05)	-0.067 (0.05)	-0.081 (0.05)
PMR					0.587 (0.62)	0.624 (0.65)
TFP						36.111** (14.90)
Output gap			-0.769*** (0.12)	-0.678*** (0.10)	-0.670*** (0.09)	-0.814*** (0.11)
R-squared	0.093	0.233	0.518	0.596	0.602	0.619
Observations	93	93	93	93	93	93
Time dummies		x	x	x	x	x
Country dummies	x	x	x	x	x	x

Robust standard errors in parentheses, *significant at 10%, ** significant at 5%, *** significant at 1%. Data is available for 19 OECD countries. Country dummies included in all regressions, time dummies included in all regressions except in I.

Table (6) reports the results for regressions with FDI-flows instead of stocks. We obtain the same sign pattern as in Table (5). The FDI-net measure is significant and negative when controlling for business cycle and labor market institutions, which further supports the results found in Table (5). However, without controlling for the business cycle or other unemployment drivers such as labor and product market regulations

Table 7: Aggregate unemployment and FDI-net, stocks and flows

	<i>Dependent variable: Total unemployment</i>									
	<i>Variable of interest: FDI-net (FDI-in minus FDI-out relative to GDP)</i>									
	I	II	III	IV	V	VI	VII	VIII	IX	X
	FE	RE	FGLS	diff-GMM	diff-GMM	FE	RE	FGLS	diff-GMM	diff-GMM
	FDI-net (flow)					FDI-net (stock)				
FDI-net	-0.047*** (0.02)	-0.010 (0.02)	-0.040*** (0.01)	-0.098*** (0.03)	-0.071*** (0.02)	-0.306** (0.14)	-0.184* (0.11)	-0.291*** (0.09)	-0.905*** (0.33)	-0.696** (0.31)
Lag dep. var.				0.074 (0.23)	0.190* (0.11)				0.210 (0.25)	0.155 (0.19)
Replacement rate	-0.031 (0.05)	-0.013 (0.04)	-0.014 (0.03)	-0.049 (0.05)	-0.035 (0.13)	-0.016 (0.05)	-0.007 (0.04)	0.009 (0.03)	-0.011 (0.08)	-0.145 (0.14)
Tax wedge	0.355*** (0.11)	0.210*** (0.07)	0.251*** (0.06)	0.239*** (0.09)	0.380** (0.19)	0.325*** (0.10)	0.189*** (0.07)	0.278*** (0.06)	0.132 (0.09)	0.550** (0.24)
EPL	-0.920 (1.40)	-0.757 (0.66)	-0.880 (0.63)	-1.080 (1.27)	-1.366 (1.69)	-1.096 (1.37)	-0.756 (0.67)	-0.875 (0.60)	-2.050 (1.70)	-2.798 (1.99)
Union density	-0.073 (0.06)	-0.088*** (0.03)	-0.110*** (0.04)	-0.214*** (0.07)	-0.189*** (0.04)	-0.081 (0.05)	-0.087*** (0.03)	-0.131*** (0.03)	-0.241*** (0.05)	-0.239*** (0.07)
PMR	0.444 (0.73)	0.712 (0.53)	0.275 (0.36)	0.421 (0.66)	0.262 (0.85)	0.624 (0.65)	0.791 (0.55)	0.534 (0.33)	0.386 (0.57)	0.367 (0.71)
TFP	20.190 (16.40)	34.915 (25.99)	23.672* (14.21)	66.205*** (19.89)	41.252** (16.61)	36.111** (14.90)	42.245 (26.24)	32.388*** (11.71)	88.113*** (33.10)	62.591** (31.34)
Output gap	-0.733*** (0.09)	-0.933*** (0.18)	-0.808*** (0.10)	-1.124*** (0.19)	-0.954*** (0.13)	-0.814*** (0.11)	-0.953*** (0.18)	-0.830*** (0.09)	-1.223*** (0.26)	-1.068*** (0.28)
R-squared	0.612	0.569			0.619	0.590				
Hausman	0.000				0.000					
Observations	91	91	91	70	70	93	93	92	73	73

Robust standard errors in parentheses, *significant at 10%, ** significant at 5%, *** significant at 1%. Data is available for 19 OECD countries over the period 1983 - 2003. Time dummies included in all regressions. Output gap and additional macroeconomic shocks capture short run fluctuations. FGLS with correction for heteroskedastic panels and cross-country correlation. Diff-GMM treats FDI-net and output gap as endogenous in IV and IX and additionally treats wage distortion as endogenous in V and X.

coefficients are not significantly different from zero. The effect is of the same magnitude and such that a one standard-derivation of *net-FDI* reduces equilibrium unemployment rates by 0.72 percentage points in the benchmark specification (VI).

Table (7) applies different models of the benchmark specification in order to investigate the robustness of the results. We distinguish between FDI-net stocks (left panel of Table 7) and flows (right panel of Table 7) and compare the outcome with the benchmark fixed-effects regression reported in I and VI. Employing a random-effects estimator yields the expected sign but the coefficient is not significant when using the FDI flow measure. The Hausman test p-value strongly suggests to superiority of the consistent fixed effects estimator. Using flows instead of stocks yields a significant and negative coefficient for both the fixed- and the random-effects estimates reported in column (VI) and (VII). In (III) and (VIII) a feasible least squares estimator is employed and allows us to control for heteroscedasticity across the countries and panel. The coefficients are close to the coefficients obtained in I and VI and indicate an effect similar to that obtained from the benchmark fixed effects regressions. The time dimension of the data is exploited to run GMM with lags of the endogenous variables used as instruments. One potential pit fall of GMM is over identification caused by too many instruments. Hence, the number of instruments is limited by focusing on variables that are potentially endogenous instead of building instruments for all variables included in the regressions.⁹ Instrumenting FDI-flow in a GMM approach indicates a (long run) relationship that is two times higher than that from the standard benchmark regressions. Including stocks in (IX) and (X) reveals the same picture.

Table (8) shows regression results for a first-difference approach. A negative sign indicates that an increase in FDI inflows (inflows minus outflows) is associated with a decrease in unemployment. The distinction between regressions that include country dummies and regressions that exclude them helps to assess the role of fixed effects. The omitted variable bias due to time invariant fixed effects should be negligible since the time dimension of the data is rather short and due to the fact that time invariant fixed effects are already purged by first differencing the data. Country dummies in this

⁹In a first step we instrument output gap and openness, and in a second step we also build instruments for the wage distortion.

particular application allow for different country intercepts which is more or less important since theory predicts that a change over time influences unemployment. We start with a simple OLS estimator in column (1) neglecting differences in the country intercepts. Concerning the *LAB* measures we get the same unsatisfying picture as many other studies on labor market institutions before. Higher replacement rates tend to decrease unemployment which contradicts search theory, but the coefficient is insignificant. Tax wedge and employment protection have the right sign but the effect is not statistically significant and thus meaningless. FDI-in (net of FDI-out) exhibit the right sign by indicating that positive changes of FDI (capital) inflows are indeed associated with a higher equilibrium rate of unemployment in the long run. Allowing for country specific intercepts increases the fit of the model. This is not a surprise since we forced all countries in regression (1) to have the same constant, somehow obscuring the country specific relationship between FDI and unemployment. Notice, that both regressions yield results that are equal in magnitude. Including country dummies however reduce the standard errors indicating that the regression line fits the data. In regression (3) and (4) we use a GLS estimator instead of OLS and receive basically the same results.

Labor market institutions and FDI. The second important proposition derived from theory is that changes in labor market institutions that benefit the workers reduce FDI-inflows and push FDI-outflows. In Table (9) we investigate this relationship by regressing the institutional variables on FDI-net. The negative coefficients of the institutional variable wage distortion for instance indicate that higher unemployment benefits are linked to lower FDI-net flows/stocks.

Table 8: Aggregate unemployment and FDI-net flows

<i>Dependent variable: Total unemployment rate</i>						
<i>Variable of interest: FDI-net (FDI-in minus FDI-out (stock) relative to GDP)</i>						
	I	II	III	IV	V	VI
	OLS	FE	FGLS	FGLS	IV	IV
Δ FDI-net	-0.016*	-0.016**	-0.014*	-0.013	-0.020	-0.027*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
Δ Replacement rate	-0.040	-0.063	-0.021	-0.047**	-0.042	-0.064*
	(0.04)	(0.04)	(0.02)	(0.02)	(0.04)	(0.04)
Δ Tax wedge	0.045*	0.041	0.031	0.030	0.045*	0.041*
	(0.03)	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)
Δ EPL	-0.590	-0.704*	-0.432	-0.532*	-0.595*	-0.703**
	(0.36)	(0.38)	(0.30)	(0.29)	(0.34)	(0.35)
Δ PMR	0.244	0.232	0.038	0.061	0.247	0.248
	(0.28)	(0.28)	(0.17)	(0.17)	(0.27)	(0.26)
Δ TFP (shock)	27.820***	28.694***	26.776***	26.608***	27.777***	28.595***
	(3.66)	(3.57)	(2.29)	(2.29)	(3.48)	(3.32)
Δ ToT (shock)	1.215	0.046	1.320	1.607	1.296	0.117
	(2.95)	(3.14)	(2.33)	(2.31)	(2.82)	(2.91)
Δ Labor demand (shock)	8.793*	14.627**	8.314**	12.229**	9.313**	15.026***
	(4.69)	(5.99)	(3.93)	(4.92)	(4.59)	(5.65)
Δ Interest rate (shock)	0.038**	0.036**	0.013	0.011	0.039***	0.037***
	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Δ Output gap	-0.647***	-0.641***	-0.596***	-0.581***	-0.646***	-0.638***
	(0.04)	(0.05)	(0.03)	(0.03)	(0.04)	(0.05)
R-squared	0.587	0.612			0.587	0.611
Partial R-squared					0.313	0.388
F-stat (1st stage)					9.853	17.037
Country dummies		x		x		x
Time dummies	x	x	x	x	x	x
Observations	365	365	365	364	364	364

Robust standard errors in parentheses, *significant at 10%, ** significant at 5%, *** significant at 1%. Data is available for 19 OECD countries over the period 1983 - 2003 with gaps and first differenced to purge country specific fixed effects. Time dummies included in all regressions. FGLS with correction for heteroskedastic panels and cross-country correlation. IV uses first lags of FDI-net as instrument to adress endogeneity.

Table 9: FDI net-flows and labor market institutions

	I	II	III	IV	V	VI	VII	VIII
	FE	RE	FGLS	IV	FE	RE	FGLS	IV
	FDI-net (stock)			FDI-net (flow)				
Wage distortion	-0.247 (0.22)	-0.126** (0.05)	-0.074* (0.04)	-0.245*** (0.09)	-0.099** (0.04)	-0.012 (0.01)	-0.042*** (0.01)	-0.124*** (0.03)
Union density	-0.322 (0.38)	-0.089 (0.09)	-0.442*** (0.07)	-0.387*** (0.14)	-0.096** (0.05)	-0.006 (0.02)	-0.055** (0.03)	-0.112*** (0.03)
EPL	-5.235 (3.53)	-3.363*** (1.11)	-3.623*** (0.98)	-6.519*** (1.81)	-2.636*** (0.70)	-0.504** (0.21)	-0.952*** (0.35)	-3.087*** (1.00)
Output gap	0.752 (0.58)	0.971*** (0.24)	0.065 (0.13)	0.734*** (0.24)	0.062 (0.07)	0.141*** (0.05)	0.034 (0.05)	0.061 (0.05)
PMR	-0.806 (2.46)	-0.178 (1.06)	1.127* (0.64)	-0.635 (0.95)	0.629 (0.41)	0.200 (0.26)	0.408* (0.22)	0.741** (0.34)
TFP (shock)	-36.409 (35.71)	-51.992** (20.69)	-9.154 (11.51)	-36.486* (19.79)	0.952 (6.30)	-6.647 (5.79)	-1.042 (4.58)	1.540 (5.66)
ToT (shock)	13.894 (37.57)	23.728 (17.26)	-10.472 (7.51)	12.447 (15.40)	7.129 (5.30)	9.462*** (3.57)	1.828 (2.45)	8.061** (4.03)
Labor demand (shock)	63.573 (61.56)	67.770*** (20.67)	15.795* (8.15)	60.668*** (19.09)	13.217 (9.05)	8.910** (3.64)	7.529** (3.07)	14.977*** (4.47)
R-square	0.417			0.897	0.197			0.419
Hausman	1.000				0.852			
N	355	355	355	338	364	364	364	348

Robust standard errors in parentheses, *significant at 10%, ** significant at 5%, *** significant at 1%. Data is available for 19 OECD countries over the period 1983 - 2003. Time dummies included in all regressions. Outputgap and additional macroeconomic shocks capture short run fluctuations. First lags of i) replacement rate (*rr*), ii) tax wedge (*tw*) and iii) EPL (*epl*) used as instruments for the IV regressions.

All labor market institutions reveal a negative sign, and only a few of them are insignificant. Using a fixed effects estimator in column (I) we find that the coefficients for wage distortion, union density, and employment protection are negative but not significant. Random effects in column (II) reveal the same sign pattern, but the coefficients are now significant for wage distortion and employment protection. Union density reveals the right sign but the effect is not significant and thus zero. The Hausman test strongly favors the random effects estimation. This result supports our theory by indicating that countries with lower labor market institutions seem to attract more FDI inflows than countries that have a tendency to protect their workers. Moreover, addressing cross panel heteroscedasticity by running FGLS yields significant and negative coefficients for all labor market institutional variables. Even union density has the right sign and is significant for FGLS. Running IV regressions and instrumenting lags of the variable wage distortion and employment protection as instruments confirm the findings in column (1) and even the magnitude of the effects do not vary by much. Partial R-squares in all regressions range from 0.6 to 0.8 indicating that the instruments are valid. In columns (5) - (8) we redo the whole procedure with FDI-flows instead of stocks, which support the findings discussed so far.

Additional results. Regressions with *skill-specific* unemployment rates as the dependent variable and *net-FDI* flows as a variable of interest are presented to test the complementarity theoretically derived in Schmerer (2010). Findings in Table (10) indicate that FDI net flows equally affect both skill groups. Countries with increasing FDI-in tend to have lower low- and high-skill unemployment rates, whereas net exporters of capital exhibit higher rates of unemployment in both skill groups.¹⁰ However, as discussed before the regressions might be plagued by endogeneity, especially when using low-skill unemployment rates. High rates of low-skill unemployment may be an alarming signal for policy makers that could lead them to protect domestic labor markets from global competition. This is to a great extent perceived as a risk for the low skilled rather than for the high-skill work force.

The results support the complementarity between both skill groups and reveals a

¹⁰ *skill-specific* unemployment rates are computed as ratio between the number of unemployed worker and the total number of workers, both with either low skill or high skill education. Simply dividing the total rate of unemployment into primary, secondary and tertiary unemployment is not enough since the basis would still be total labor. For *skill-specific* unemployment rates we need the information on the number of workers available with a certain education. This data is also provided through the WDI database.

Table 10: Skill Specific Unemployment and FDI net-flows

<i>Dependent variable: skill-specific unemployment</i>						
<i>Variable of interest: FDI-net (FDI-in minus FDI-out (stock) relative to GDP)</i>						
FE regressions						
VARIABLES	u (low)	u (high)	u (low)	u (high)	u (low)	u (high)
FDI-net	-0.106** (0.043)	-0.092* (0.052)	-0.085*** (0.028)	-0.070** (0.033)	-0.075** (0.029)	-0.062* (0.031)
Wage distortion			0.169* (0.088)	0.104 (0.064)	0.130 (0.093)	0.070 (0.066)
EPL			-0.606 (0.916)	-1.783 (1.093)	-1.133 (0.876)	-2.267** (1.030)
PMR			1.986** (0.829)	2.573** (1.126)	2.145*** (0.724)	2.736** (1.020)
Interestrate shock					0.066* (0.036)	0.036** (0.017)
TFP					39.810*** (10.025)	38.152*** (11.750)
ToT (shock)	63.081*** (20.843)	45.840 (27.422)	51.557*** (14.684)	31.535* (17.441)	50.639*** (13.290)	31.450* (15.410)
Labor demand (shock)	35.501** (14.274)	25.797 (18.466)	29.778* (15.019)	18.374 (18.736)	38.359*** (12.525)	26.497 (17.071)
Output gap	-0.813*** (0.143)	-0.536*** (0.134)	-0.720*** (0.144)	-0.472*** (0.101)	-0.850*** (0.145)	-0.598*** (0.105)
Observations	125	125	125	125	125	125
R-squared	0.777	0.682	0.838	0.783	0.875	0.827

Robust standard errors in parentheses, *significant at 10%, ** significant at 5%, *** significant at 1%. Data is available for 19 OECD countries over the period 1993 - 2003. Outputgap and additional macroeconomic shocks included to capture short run fluctuations. Country and time dummies included in all regressions.

negative sign for both type of workers. Moreover, the magnitude of the effect is stronger for the low-skilled than for high-skilled. We find that a one-standard deviation increase in net FDI reduces low skill unemployment by 1.66 percentage points and 1.44 percentage points for the high-skilled. The result stems from the fact that the high skill unemployment rate is lower and exhibits less variation than low-skill unemployment. Again, we also find that the magnitude of the effect becomes smaller once we reduce the omitted variable bias by including additional control variables. Controlling for the full set of variables reduces the effect of a one-standard deviation of net-FDI to 1.17 percentage point for high-skill and 0.97 percentage points for low-skill unemployment. Concerning product market regulation we find the opposite effect. PMR tends to increase both rates of unemployment but the effect appears to be stronger for high skill than for low

skill workers. Deviations in GDP from its long run trend also harms low skill workers more than high skill workers in all model setups.

Table 11: Skill Specific Unemployment and FDI net-flows

<i>Dependent variable: skill-specific unemployment</i>		<i>Variable of interest: FDI-net (FDI-in minus FDI-out (stock) relative to GDP)</i>									
VARIABLES	IV regressions										
	u (low)	u (high)	u (low)	u (high)	u (low)	u (high)	u (low)	u (high)	u (low)	u (high)	
FDI-net	-0.096** (0.045)	-0.080*** (0.031)	-0.102** (0.051)	-0.084** (0.036)	-0.087* (0.048)	-0.069** (0.045)	-0.074 (0.045)	-0.065* (0.034)			
Wage distortion	0.040 (0.045)	0.022 (0.034)	0.068 (0.043)	0.036 (0.031)	0.029 (0.060)	0.017 (0.045)	0.049 (0.055)	0.022 (0.038)			
EPL	-1.889*** (0.716)	-1.205 (0.742)	-1.635 (1.042)	-1.089 (0.775)	-2.218*** (0.759)	-1.452* (0.786)	-1.809* (1.047)	-1.211 (0.791)			
PMR	1.355** (0.625)	1.185* (0.643)	1.274** (0.648)	1.200* (0.676)	1.408** (0.695)	1.113 (0.679)	1.220* (0.669)	1.071 (0.711)			
TFP	18.121* (9.527)	14.302** (5.825)	24.678** (11.593)	16.960*** (6.264)	28.024*** (9.412)	21.449*** (5.590)	39.423*** (9.704)	25.421*** (5.358)			
Union density	-0.061 (0.079)	0.050 (0.051)	0.009 (0.081)	0.094* (0.051)	-0.116 (0.088)	-0.004 (0.065)	-0.021 (0.077)	0.050 (0.055)			
ToT (shock)	22.837** (11.596)	10.317 (6.603)	15.569 (10.821)	4.210 (6.139)	8.897 (10.978)	4.017 (6.521)	6.902 (10.172)	2.420 (6.573)			
Real interest (shock)	0.029 (0.044)	-0.007 (0.021)	0.029 (0.032)	0.008 (0.018)	0.031 (0.045)	-0.002 (0.018)	0.026 (0.031)	0.006 (0.015)			
Output gap	-0.761*** (0.120)	-0.347*** (0.085)	-0.778*** (0.111)	-0.420*** (0.078)	-0.855*** (0.168)	-0.443*** (0.089)	-0.908*** (0.121)	-0.541*** (0.071)			
Year dummies	x		x		x		x				
R-squared	0.608	0.454	0.523	0.381	0.638	0.535	0.571	0.495			
Partial R-squared	0.198		0.192		0.199		0.196				
F-stat (1st stage)	20.304		20.501		9.958		10.429				
OID-test					0.902		0.661				
Observations	92	92	92	92	74	74	74	74			

Robust standard errors in parentheses, *significant at 10%, ** significant at 5%, *** significant at 1%. Data is available for 20 OECD countries over the period 1993 - 2003. Output gap and additional macroeconomic shocks included to capture short run fluctuations. All variables are first differenced and FDI is instrumented with its second lag (Anderson and Hsiao 1981, 1982). Additional first lag used in regression (5) - (6).

Table (11) As a further robustness check we perform regressions using the methodology proposed in Anderson and Hsiao (1981, 1982) to address the endogeneity issue by first-differencing the data and by using the second lag of the FDI variable as an instrument. Several setups were tested but only those setups where the second lag of the endogenous variable is included as instrument yield satisfying instruments concerning the test statistics. The first-stage F-statistic is between 10 and 20 for all regressions and the partial R-square is around 0.2. Again, the robust finding that *i*) both skill groups are equally affected by FDI and *ii*) that the magnitude of the effect is stronger for low skilled than for high skill is also apparent when controlling for endogeneity. First differenced *net-FDI* is instrumented with the second lag of *net-FDI* in Column I - IV. Time dummies are included in I and II but excluded in III and IV. Excluding the time dummies yields better results for the test statistics concerning the instruments' validity. Excluding time dummies is the preferred setup given that the time dimension is rather short. Nevertheless, we always report both type of regressions as further robustness checks. In column V to VIII we also include the second lag in first differences which allows us to run a test on exogeneity.

7. Conclusion

This paper advances a simple multi-industry trade model with imperfect labor markets due to Mortensen and Pissarides type of search frictions. Wages in this setup are jointly determined by labor market institutions and international trade, thereby affecting the equilibrium rate of unemployment at the intensive and extensive margin of labor demand. This two-dimensional causality between foreign direct investments and wages (unemployment) also permits the study of changes in the exogenously given labor market institutional environment. Institutions itself remain unaffected by firm behavior or trade so that wages are set according to the conditions in the labor market. Conversely, policy makers may influence labor market outcomes for whatever reason by readjusting labor market institutions. The model proposed above suggests that such a reform would necessarily affect trade, wages and unemployment in all countries integrated through the trade in goods and capital.

This paper's major contribution is to test and to quantify the opposing effects at the intensive and extensive margin of labor demand by confronting the model with data

taken from the OECD. We successfully test the main hypothesis derived in the theory chapter in that we show that the FDI-receiving countries tend to have lower rates of unemployment, whereas an increase in FDI-outflows increase equilibrium unemployment.

The newly introduced Mortensen and Pissarides (1994) search and matching mechanism within the Feenstra and Hanson model also opens a novel channel through which changes in the workers' wage rate initiated by changes in labor market reforms induce capital flows between the countries. For instance an increase in the workers' income reduces the respective countries competitiveness in all industries. However, the reduced competitiveness only affects some of the industries located near the cutoff which will be sifted abroad. Given that interest rates are exogenously given, such a loss in competitiveness leads to excess capital supply in the contracting and excess-demand in the expanding country. Our results support this finding in that it suggest that countries with less stringent labor market institutions tend to have larger FDI-inflows and thus have lower rate of unemployment.

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8. Appendix

8.1. Data description

Unemployment rates For our OECD benchmark regressions we use total unemployment, measuring the percentage share of unemployed workers in total labor force (15 - 66 years old individuals). Data taken from Basanini and Duval. Original Source: OECD, Database on Labour Force Statistics; OECD, Annual Labour Force Statistics.

To estimate the effects of FDI on *skill-specific* unemployment rates we use data from the WDI to disentangle the WDI total unemployment rate into its *skill-specific* components. Low skill labor is constructed using data on workers with primary education only. High skill labor is an averaged variable gathering workers with secondary and tertiary education.

FDI measures FDI-net is measured as difference between inward-FDI and outward-FDI relative to GDP. *FDI* is taken from the UNCDAT data base and includes transactions of firms from foreign countries with a share of at least 10% in a domestic company. *FDI* stocks and flows are measured in current U.S. Dollar so that real GDP from the Pennworld table 6.4 was used to construct FDI-net intensities in order to make the data comparable across countries. We distinguish between stocks and flows of *FDI*. *Inward-FDI* are investments from abroad into the reporting country. *FDI-outflows* denotes FDI from the reporting country made in other countries.

Wage distortion Wage distortion lumps replacement rate and tax wedge together. Both variables affect unemployment through the same channel, namely wages. Therefore lumping both variables together further reduces the number of instruments when estimating GMM regressions.

Replacement rate Average unemployment benefits taken from the Basanini and Duval data set. Original source: OECD Benefits and Wages Database. According to Basanini and Duval data is available for odd years only, so that they had to fill the gaps by linear interpolation.

Tax wedge This variable measures taxation on wages by computing the difference between wages paid by employers and wages earned by employees. The variable on tax wedge is constructed using the OECD taxing wages data. Some observations were adjusted by B&D in order to fill the gaps in the data, thus providing a complete sample for the period 1982 - 2003.

Union density Union density measures the percentage share of workers associated to unions. According to B&D the data was taken from the OECD Employment Outlook 2004 and inter / extrapolated in order to maximize the sample.

High corporatism Dummy variable that takes the value one if wage bargaining is highly centralized. Source: Basanini and Duval.

EPL Measures the stringency of employment protection legislation, taken from Basanini and Duval. Original source: OECD, Employment Outlook 2004.

PMR Measures the regulation on product markets and competition, taken from Basanini and Duval. Original source: Conway et al. (2006).

Total factor productivity shock a macroeconomic shock variable that measures the derivation of total factor productivity from its trend using a Hodrick-Prescott filter. Data on TFP is obtained by computing the Solow residual. Source: Basanini and Duval.

Terms of trade shock Terms of trade measure the relative price of imports weighted by the share of imports in GDP.

Real interest shock Measure of the difference between the 10-year nominal government bond yield and the annual change in the GDP deflator.

Labour demand shocks Definition: logarithm of the labour share in business sector GDP purged from the short-run influence of factor prices.

Output gap Output gap measures the difference between actual and potential GDP as percentage of potential output. As source B&D cite the OECD Economic outlook and IMF International finance statistics.

OECD panel			OECD panel (5 year averages)			OECD Skill-Specific Sample		
Variable	Mean	Std. Dev.	Variable	Mean	Std. Dev.	Variable	Mean	Std. Dev.
Unemployment (total)	8.028	4.460	Unemployment (total)	7.056	3.827	Unemployment (total)	7.796	4.170
Unemployment (low skill)	–	–	Unemployment (low skill)	11.269	7.812	Unemployment (low skill)	11.053	4.378
Unemployment (high skill)	–	–	Unemployment (high skill)	8.591	3.961	Unemployment (high skill)	6.291	3.943
FDI-net stocks (FDI-in minus FDI-out)	–1.065	15.718	FDI-net stocks (FDI-in minus FDI-out)	–0.205	20.580	FDI-net stocks (FDI-in minus FDI-out)	–7.108	17.472
FDI-net flows (FDI-in minus FDI-out)	–0.547	2.360	FDI-net flows (FDI-in minus FDI-out)	–0.287	2.283	FDI-net flows (FDI-in minus FDI-out)	27.092	22.315
Wage distortion (replace. r. + tax wedge)	58.234	18.499	Wage distortion (replace. r. + tax wedge)	58.213	17.835	Wage distortion (replace. r. + tax wedge)	57.662	17.371
Replacement rate (index)	29.175	13.090	Replacement rate (index)	28.403	12.73	Replacement rate (index)	29.078	12.295
Tax wedge (index)	29.058	9.026	Tax wedge (index)	28.712	8.928	Tax wedge (index)	28.583	8.673
Union density (index)	39.577	21.019	Union density (index)	41.653	20.301	Union density (index)	37.387	21.323
High corporatism (dummy)	0.557	0.497	High corporatism (dummy)	0.561	0.486	High corporatism (dummy)	0.576	0.496
EPL (index)	2.026	1.058	EPL (index)	2.086	1.091	EPL (index)	1.840	0.906
PMR (index)	3.875	1.236	PMR (index)	3.848	1.293	PMR (index)	2.723	0.975
Output gap (actual - potential GDP)	–0.899	2.473	Output gap (actual - potential GDP)	–0.718	1.739	Output gap (actual - potential GDP)	–0.550	1.844
TFP (shock)	–0.0004	0.021	TFP (shock)	–0.0009	0.011	TFP (shock)	0.003	0.015
Interest rate (shock)	4.873	2.183	Interest rate (shock)	3.534	2.834	Interest rate (shock)	3.613	2.103
Labor demand (shock)	0.0301	0.059	Labor demand (shock)	0.025	0.060	Labor demand (shock)	0.0470	0.065
Terms of trade (shock)	–0.039	0.062	Terms of trade (shock)	–0.028	0.070	Terms of trade (shock)	–0.080	0.055

Figure 2: Summary statistic

9. Proofs

Proof of Lemma (1). To derive the Equilibrium market tightness condition intermediate input producers we need to derive and interact the wage and the job creation curves by establishing the problem of the firm and worker according to Pissarides (2000), Dutt et al. (2009), or Schmerer (2010).

Wage bargaining and job creation on level 2 On level 2 intermediate input produces produce for the assembling process of good $x_i(z)$ on level 2 and each firm employs one worker and produces one unit of the intermediate good. Firms have to post vacancies in order to recruit new workers, which incurs vacancy posting costs. In the following we assume that firms pay recruitment cost c in some common units p . This is a more general formulation as in Pissarides (2000) where vacancy costs are paid in terms of the individual price or Felbermayr, Prat, Schmerer (2007) where vacancy costs are paid in terms of the aggregate price level. This common vacancy price index p is measured either in units of numeraire, intermediate goods price, aggregate price level or wage.¹¹ In line with Pissarides (2000), I assume that vacancy posting costs are paid in terms of level 1 prices when solving the general equilibrium of the model. The matching process itself is modeled by a standard Cobb-Douglas matching function $m(\theta)$, which is concave and has constant returns to scale properties.

Job Creation J denotes the present discounted value of expected profit from an occupied job in skill group k and V the value of a vacant job. The value of a vacant job negatively depends on unit recruitment costs, but increases in the difference between the value of the filled job and the opportunity costs given by the value of the vacant job. The matching function itself pins down the probability of a successful match due to the assumption of constant returns to scale. The flow value of the filled job is revenue generated by the worker minus the wage rate paid to the worker.¹² Job separation due to an exogenous shock hits the firm with poisson arrival rate λ and destroys the value

¹¹One important feature of p is that it is measured in the common unit. Income, wages, and prices have the same units and are therefore valid.

¹²A firm's revenue $\varrho(z)$ equals the price charged for each intermediate good due to the small firm assumption. Prices still depend on z but it is possible to proof that prices do not hinge on industry specific parameters.

associated with that firm.

$$\eta V = -cp + m(\theta)(J - V) \quad (21)$$

$$\eta J = \varrho(z) - w - \lambda J \quad (22)$$

In equilibrium the value of unoccupied jobs is zero since firms continue to post vacancies until all profits are exploited

$$J = \frac{cp}{m(\theta)} \quad (23)$$

We can combine both equilibrium conditions in order to obtain the Job Creation condition

$$\varrho(z) - w - \frac{cp}{m(\theta)}(\eta + \lambda) = 0 . \quad (24)$$

This Job Creation condition states that the firm's revenue must equal variable production and recruitment costs under perfect competition with search frictions in the labor market. Suppose that wages are equalized across firms. This proposition is proved below and due to the definition of equilibrium market tightness which is the ratio between the number of vacancies posted and the number of unemployed workers. It is sufficient to compute the optimal wage/equilibrium market tightness for the cutoff firm. However, unit costs/prices differ across firms since per worker costs for the intermediate good are equal but the input requirement of workers (intermediate good from level 2) in z is lower if $z < z'$.

Wage Curve To the worker the value of a job is worth the wage minus the opportunity cost of being employed. However, his firm might be destroyed with a certain probability. In that particular case the value of the job is destroyed and the worker receives her outside option worth rU . Unemployed workers receive some unemployment benefits b and with a certain probability they successfully find a new job in another firm.

$$\eta W = w - \lambda(W - U) \quad (25)$$

$$\eta U = b + m(\theta_h)(W^e - U) \quad (26)$$

W^e is expected value of a job. By introducing W^e we take into account that workers are randomly matched to firms and therefore have to build expectations about W . This also implies that all firms pay the same wage rate and therefore only differ with respect to their production given the equilibrium wage.

Wages itself are bargained and satisfy

$$W - U = \beta(J + W - V - U) \quad (27)$$

This implies

$$w = \eta U + \beta(\varrho(z) - rU) \quad (28)$$

and

$$\eta U = b + \frac{\beta}{1 - \beta} cp\theta \quad (29)$$

In the end we obtain an aggregate wage equation

$$w = (1 - \beta)b + \beta cp\theta + \beta \varrho(z) \quad (30)$$

Which is the pendant to the labor supply curve in the standard Feenstra and Hanson model.

To solve for the job creation curve equation (23) and (22) are combined so that

$$(\eta + \lambda) \frac{cp}{m(\theta)} = \varrho(z) - w \quad (31)$$

which can be rearranged to equation (24). To solve for the wage curve we start with rearranging equation (27) as

$$W - U = \frac{\beta}{1 - \beta} J \quad (32)$$

where we can substitute for J using equation (22)

$$(\eta + \lambda)J = \varrho(z) - w \quad (33)$$

$$(34)$$

Rearranging equation (25)

$$(\eta + \lambda)(W - U) = w + \lambda U - (\eta + \lambda)U \quad (35)$$

$$(\eta + \lambda)(W - U) = w - \eta U \quad (36)$$

The outside option is obtained by solving equation (26)

$$\eta U = b + \theta m(\theta) \frac{\beta}{1 - \beta} \frac{cp}{m(\theta)} \quad (37)$$

Combining equation (32), (35), and (36) gives

$$(\eta + \lambda) \frac{\beta}{1 - \beta} J = w - \eta U \quad (38)$$

$$(\eta + \lambda) \frac{\beta}{1 - \beta} \frac{\varrho(z) - w}{\eta + \lambda} = w - \eta U \quad (39)$$

$$(\eta + \lambda) \frac{\beta}{1 - \beta} \frac{\varrho(z) - w}{\eta + \lambda} = w - b - \theta m(\theta) \frac{\beta}{1 - \beta} \frac{cp}{m(\theta)} \quad (40)$$

$$\beta \varrho(z) - \beta w = (1 - \beta)w - (1 - \beta)b - \theta \beta cp \quad (41)$$

$$w = (1 - \beta)b + \beta(\varrho(z) + \theta cp) \quad (42)$$

To solve for the equilibrium intermediate good price we can interact the wage curve (30) and the job creation curve (24) and solve for $\varrho(z)$

$$(1 - \beta)b + \beta(\varrho(z) + \theta cp) = \varrho(z) - (\eta + \lambda) \frac{cp}{m(\theta)} \quad (43)$$

$$\varrho(z) = b + \frac{cp}{1 - \beta} \left(\beta \theta + \frac{\eta + \lambda}{m(\theta)} \right) \quad (44)$$

Equilibrium on level 2 In equilibrium, the wage and the equilibrium market tightness θ are determined by interacting the wage curve and the job creation curve such that

$$(1 - \beta)b + \beta cp \theta + \beta \varrho(z) = \varrho(z) - \frac{cp}{m(\theta)} (\eta + \lambda) . \quad (45)$$

Simplifying then yields

$$\varrho(z) = \left(b + \frac{cp}{1 - \beta} \left(\beta \theta + \frac{\eta + \lambda}{m(\theta)} \right) \right) . \quad (46)$$

Therefore, all level 1 firms pay the same price for intermediate goods denoted $q(z)$ so that $q(z') = q_h(z'')$ for $z' \neq z''$. Prices only depend on exogenous parameters and the equilibrium market tightness, which is common to all firms in all industries.

Proof of Lemma 2. First, notice that the left hand of the LMC curve Γ_L is well behaved due to the convexity of the Beveridge curve. For $\lim_{\theta \rightarrow \infty} \Gamma_L = L$ since $\lim_{\theta \rightarrow \infty} u(\theta) = 0$. Let the equilibrium market tightness go to zero and we find that $\lim_{\theta \rightarrow 0} \Gamma_L = 0$ since $\lim_{\theta \rightarrow 0} u(\theta) = 1$. Thus, for $\theta = 0$ we have full unemployment and no worker is willing to search for a job.

The right hand side of the LMC curve is also well behaved. Demand for intermediates hinges on the intermediate goods prices q and q depends on exogenous parameters and the equilibrium market tightness. However, equation (45) is asymptotic in θ so that the necessary restriction for θ is

$$\beta\theta + \frac{\eta + \lambda}{m(\theta)} < \frac{(1 - \beta)}{c}$$

to secure that $q(\theta) > 0$. However, this is not a strong assumption for reasonable values of the exogenous parameters as shown in the calibration section. The first derivative of equation (45) is positive since

$$\frac{\partial q(\theta)}{\partial \theta} = - \frac{-c [\beta + \alpha(\eta + \lambda)m\theta^{\alpha-1}] (1 - \beta)b}{\left[(1 - \beta) - c(\beta\theta + \frac{\eta + \lambda}{m(\theta)}) \right]^2} > 0$$

which is needed to derive $\frac{\partial \Gamma_R}{\partial \theta} < 0$. It is enough to apply the Leibnitz rule on Γ_R in order to derive

$$\frac{\partial \Gamma_R}{\partial q} = \int_{\underline{z}_d}^{\bar{z}_d} -\zeta \varphi(z) E(q_d(\theta))^{-2} dz < 0 \quad (47)$$

which implies that $\frac{\partial \Gamma_R}{\partial \theta} < 0$. To derive this proof the assumption that the upper and the lower bound remain constant.

Proof of Proposition (1). Part a) follows immediately by deriving the first derivative of Γ_R with respect to z^* . Notice, that for each country we ex-ante know whether z^* is the upper or lower bound. In the two country scenario both countries have one constant bound (either 0 or 1) and one variable bound z^* . So it is important to determine whether z^* is the upper or lower bound for each country, which depends on the regarded country's comparative advantage. For the moment we assume that home has a comparative advantage in the production of goods closer to 1 and foreign has a comparative advantage in the production of goods closer to 0. For the home country z^* is

therefore the lower bound of active industries. Changing the bounds and deriving the first derivative with respect to z^* therefore yields

$$\frac{\partial \Gamma_R}{\partial z^*} = -\varphi(z^*)E < 0 \quad (48)$$

and respectively

$$\frac{\partial \Gamma_R}{\partial z^*} = \varphi(z^*)E > 0 \quad (49)$$

An increase in the cutoff industry thus reduces labor demand at the extensive margin due to a reduction in active industries.

Part b) follows from the assumption made about relative skill endowments and technology that $a_h > a_l$ and c) is also straightforward. This result and Lemma 2 are necessary to proof Proposition (1). The assumption that interest rates are endogenously determined implies that capital flows must be compensated by a change in interest rates. Capital outflows for instance makes capital more scarce. The reduction in supply therefore must be compensated by a readjustment in capital cost. Suppose that everything else remains equal for the moment. Such an increase in capital cost shifts the unit cost curves upward. The reverse applies for the capital inflow country where the increases capital supply will shift the unit cost curves downward. The former cutoff z^* cannot be optimal anymore and must change. The capital outflow country loose its comparative advantage in some industries close to the former cutoff and the capital inflow country will extend its production to industries formerly associated to the outflow country and z^* will readjust. Proposition 1 immediately implies that Γ_R in the outflow country will fall and Γ_L in the inflow country will rise. To restore equilibrium, wages and thus unemployment have to readjust so that $\Gamma_L = \Gamma_R$ again. Wages and thus intermediate good prices in the outflow country must decrease and wages in the inflow country must increase.

Proof of Proposition 2. The first derivative of the ETC curve with respect to b is

$$\frac{\partial q}{\partial b} = \frac{(1 - \beta)}{(1 - \beta) - c(\beta\theta + \frac{\eta+\lambda}{m(\theta)})} > 0 \quad (50)$$

Thus, the intermediate good's price q increases for each θ which shifts the respective unit cost curve upwards. Again the former equilibrium z^* is not optimal anymore and

the adjustments are similar to the adjustments in Proposition 1. Take for instance an increase in the bargaining power. Again, the first derivative reads

$$\frac{\partial q}{\partial \beta} = \frac{-b \left[(1 - \beta) - c \left(\beta \theta + \frac{\eta + \lambda}{m(\theta)} \right) \right] + (1 - \beta) bc \theta}{\left[(1 - \beta) - c \left(\beta \theta + \frac{\eta + \lambda}{m(\theta)} \right) \right]^2} \quad (51)$$

$$= \frac{-b(1 - \beta) + bc\beta\theta + bc\beta \frac{\eta + \lambda}{m(\theta)} + (1 - \beta)bc\theta + (1 - \beta)}{\left[(1 - \beta) - c \left(\beta \theta + \frac{\eta + \lambda}{m(\theta)} \right) \right]^2} \quad (52)$$

$$= \frac{-b(1 - \beta) + bc\beta \frac{\eta + \lambda}{m(\theta)} + bc\theta + (1 - \beta)}{\left[(1 - \beta) - c \left(\beta \theta + \frac{\eta + \lambda}{m(\theta)} \right) \right]^2} > 0 \quad (53)$$

$$(54)$$

The inequality sign holds if $b < 1$. The shift of the unit cost schedule and the change in the cutoff industry also affects the other countries through spillover effects according to Proposition 1.